CLAIMS

What is claimed is:

1. A neural stimulation system comprising an implantable neural stimulator and a remote control unit, wherein

the implantable neural stimulator comprises:

an electrode array having a multiplicity of electrode contacts positionable to be in contact with body tissue that is to be stimulated,

an implantable coil,

an implantable microphone, and

implantable control circuitry connected to the electrode array, implantable coil, and implantable microphone, said implantable control circuitry comprising

pulse generation circuitry that generates stimulation pulses that are applied to the body tissue through selected ones of the multiplicity of electrode contacts as controlled by audio control signals received through the implantable microphone, and

a transmitter circuit that generates a back telemetry signal and applies the back telemetry signal to the implanted coil for broadcasting to the remote control unit; and wherein

the remote control unit comprises:

an external coil,

a receiver circuit connected to the external coil that senses the back telemetry signal broadcast from the implantable control circuitry through the implantable coil,

a speaker,

an audio transmitter coupled to the speaker that broadcasts the audio control signals from the speaker;

wherein audio control signals are sent to the implantable neural stimulator from the remote control unit for the purpose of controlling the implantable neural stimulator, and wherein back telemetry signals generated by the implanted neural stimulator are sent to the remote control unit for the purpose of providing an indication as to whether audio control signals sent to the implantable neural stimulator were successfully received within the implantable neural stimulator.

2. The neural stimulator system of Claim 1 wherein the receiver circuit within the remote control unit senses the back telemetry signals broadcast from the transmitter circuit when the implantable coil and the external coil are separated by a distance of D2 cm, where the distance D2 is at least about 45 cm.

3. The neural stimulator system of Claim 1 wherein the receiver circuit within the remote control unit senses the back telemetry signals broadcast from the transmitter circuit when the implantable coil and the external coil are separated by a distance of D2 cm, where the distance D2 is not greater than about 60 cm.

4. The neural stimulator system of Claim 1 wherein the remote control until further includes a visual display that displays the status of back telemetry signals received from the implantable neural stimulator.

5. The neural stimulator system of Claim 4 wherein the implantable neural stimulator system comprises an implantable cochlear stimulation system adapted to provide electrical stimulation through selected ones of the multiplicity of electrode contacts on the electrode array to a cochlea of a user.

6. The neural stimulator system of Claim 5 wherein the implantable control circuitry within the cochlear stimulation system includes an implantable speech processor adapted to process signals received through the implantable microphone.

7. The neural stimulator system of Claim 5 wherein the audio transmitter generates a *n*-bit burst command word, where *n* is an integer of between 4 and 32, modulated using frequency-shift-keying (FSK).

8. The neural stimulator system of Claim 7 wherein the FSK modulation of the command word comprises FSK modulation that varies between frequencies f1 and f2 Hz, at a rate of between 300 to 1200 bits per second.

9. A remote control unit for controlling an implantable neural stimulator, said implantable neural stimulator having an implantable microphone adapted to sense an externally-generated acoustic control signal, and an RF transmitter adapted to generate a radio frequency (RF) back telemetry signal, said remote control unit comprising:

an acoustic generator that generates acoustic control signals; and

an RF receiver circuit adapted to receive RF back telemetry signals generated by the implantable neural stimulator;

wherein the acoustic generator includes means for sending acoustic control signals to the implantable neural stimulator over a distance of at least about 45 cm, and

wherein the RF receiver circuit includes means for receiving RF back telemetry signals from the implantable neural stimulator over a distance of at least about 45 cm.

10. The remote control unit of Claim 9 wherein the RF back telemetry signal comprises a BPSK-modulated RF signal and wherein the RF receiver circuit includes means for amplifying and demodulating the BPSK-modulated RF signal.

11. The remote control unit of Claim 9 wherein the RF receiver circuit includes

an antenna coil,

a resonator and match circuit connected to the antenna coil,

an RF receiver/demodulator connected to the resonator and match circuit,

a control circuit connected to receive an output signal from the RF receiver/demodulator, and

a display unit coupled to the controller circuit; and

wherein the controller circuit includes means for determining the status of the RF back telemetry signal and for providing an indication on the display unit of said status.

12. The remote control unit of Claim 11 wherein the acoustic generator includes a button array coupled to the control circuit, a speaker driven by the control circuit, and control means within the controller circuit responsive to activation of the button array for generating desired acoustic control signals that are broadcast through said speaker.

13. The remote control unit of Claim 12 wherein the antenna coil comprises a rod antenna.

14. The remote control unit of Claim 12 wherein the acoustic generator

generates a *n*-bit burst command word, where *n* is an integer of from 4 to 32, modulated using frequency-shift-keying (FSK).

15. The remote control unit of Claim 14 wherein the FSK modulation of the command word comprises FSK modulation that varies between f1 and f2 Hz, at a rate of between 300 to 1200 bits per second.

16. A method of controlling an implantable neural stimulator, the implantable neural stimulator having an implantable microphone for receiving externally-generated acoustic signals, and an implantable coil through which back telemetry signals may be transmitted, the method comprising:

establishing a full-duplex communications channel between the implantable neural stimulator and a remote control unit, wherein the full-duplex communications channel includes a first signal path through which command signals are sent to the implantable neural stimulator and a second signal path through with status signals are received from the implantable neural stimulator;

sending acoustic control signals through the first signal path, said acoustic control signals comprising the command signals; and

receiving back telemetry signals through the second signal path, said back telemetry signals comprising the status signals.

17. The method of Claim 16 wherein sending acoustic control signals comprises generating a *n*-bit burst command word, where *n* is an integer of between 4 and 32, and modulating the 32 bit burst command work using frequency-shift-keying (FSK) modulation.

18. The method of Claim 17 wherein modulating the *n*-bit burst command word comprises applying FSK modulation to the *n*-bit burst command

word that varies between frequency f1 Hz and frequency f2 Hz, at a rate of between approximately 300 to 1200 bits per second.

19. The method of Claim 18 wherein f1 comprises 1200 Hz and f2 comprises 2400 Hz.

20. The method of Claim 16 wherein receiving back telemetry signals comprises receiving a modulated RF carrier signal, wherein the RF carrier signal has a frequency of approximately 10.7 MHz, and wherein the RF carrier signal is modulated using modulation selected from BPSK, QPSK or FM.